School of Computing, Engineering, and the Built Environment
Edinburgh Napier University

PHD STUDENT PROJECT

Funding and application details

Funding status: Self funded students only

Application instructions:
Detailed instructions are available at https://blogs.napier.ac.uk/scebe-research/available-phd-student-projects/

Prospective candidates are encouraged to contact the Director of Studies (see details below) to discuss the project and their suitability for it.

Project details

Supervisory Team:
- DIRECTOR OF STUDY: Leni Le Goff (Email: l.legoff2@napier.ac.uk)
- 2ND SUPERVISOR: Emma Hart

Subject Group: Computer science

Research Areas: Computer Science, Robotics

Project Title: Evolutionary Robotics: Generating diverse and functional robots by jointly optimising their body-plan and controllers

Project description:

The PhD project will explore optimisation, learning and/or adaptation in the context of evolutionary robotics. Areas of interest include the co-evolution of morphology and control of robots the interaction of evolution and learning mechanisms to produce bodies and behaviours that are specialised to specific environments and tasks. Alternative projects might focus on adaptation of behaviour only, using learning methods (e.g. evolution, reinforcement learning) to adapt controllers in real time to adapt to new environments, or learning repertoires of behaviours to enable robust performance. Another promising area is in the use of state-of-the art methods from the quality-diversity literature to fully explore rich search spaces

of both morphologies and controller. Projects can be conducted in simulation only but there is also the possibility to utilise our robotics laboratory to conduct experiments on physical robots. A software and hardware framework to jointly optimise the body and controllers of real robots developed by the ARE project will also be available for candidates to expand.

References:

[1] If it evolves it needs to learn AE Eiben, E. Hart 2020
[2] The Effects of Learning in Morphologically Evolving Robot Systems J Luo et al. 2022
[3] Morpho-evolution with learning using a controller archive as an inheritance mechanism Le Goff et al. 2022
[4] How the Morphology Encoding Influences the Learning Ability in Body-Brain Co-Optimization Pigozzi et al. 2023
[5] Comparing Robot Controller Optimization Methods on Evolvable Morphologies van Diggelen et al. 2023
[6] Embodied Intelligence via Learning and Evolution Gupta et al. 2021

Candidate characteristics

Education:

A first-class honours degree, or a distinction at master level, or equivalent achievements in Computer Science, Engineering, Robotics

Subject knowledge:

- AI - ideally Machine Learning/Evolutionary Computation/Reinforcement Learning
- Robotics

Essential attributes:

- Excellent programming skills ideally in C++ and Python
- Excellent writing skills